MULTIPOLLUTANT ASSESSMENT OF SHORT-TERM MORTALITY EFFECTS OF FINE PARTICULATE MATTER, ITS CHEMICAL CONSTITUENTS AND GASEOUS POLLUTANTS IN U.S. CITIES.

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Background and Aims: U.S., European, and Canadian multi-city studies have shown relatively consistent short-term mortality effects of particulate matter (PM) and ozone. However, there is less information available for the effects of other gaseous pollutants and the role of PM chemical components. The objective of this study was to identify specific characteristics (e.g., source type) of the air pollution mixture in major U.S. cities.

Methods: We assembled and analyzed mortality and air pollution data for 64 major U.S. cities where fine particulate matter ($PM_{2.5}$), key $PM_{2.5}$ chemical constituents, ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide, and sulfur dioxide were all available for the years 2001-2006. In addition to analyzing individual pollutants, we conducted factor analysis with $PM_{2.5}$ chemical constituents and gaseous pollutants. All-cause mortality risk estimates for the pollutants at lag 0 through 3 days were estimated using Poisson regression models in individual cities, adjusting for temporal trends, immediate and delayed temperature, and day of week. Risk estimates from individual cities were combined in a second-stage random effects model.

Results: Of the criteria pollutants, PM_{25}, NO_2, and O_3 were each associated with all-cause daily deaths, with NO_2 showing the strongest association (e.g., percent excess death of 0.33% [95%CI: 0.17, 0.49] per 10 ppb increase in 24-hr average at lag 1 day). Factor analysis yielded several components that could be interpreted as traffic (EC, OC, NO_2), soil (Al, Si), metals (Pb, Zn), coal (As, Se), sea salt (Na, Cl), and residual oil (Ni, V). Soil and traffic factors showed significant or nearly significant associations with mortality, with magnitudes similar to those for the criteria pollutants per comparable distributional increment, despite the smaller sample size.

Conclusion: Both regional and local pollutants contribute to short-term mortality effects.

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